STATE OF ALASKA

Bill Sheffield, Governor

Annual Performance Report for

INTERIOR WHITEFISH PROGRAM

by

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SPECIAL PROJECT SEGMENT

State: Alaska Name:

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Cooperators: Kenneth T. Alt, Alaska Department of Fish and Game, and U.S. Fish and Wildlife Service Fishery Resources, Fairbanks

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Note: This radio-tagging study was not part of our DJ sponsored study contract. However, it was a cooperative study with Fish and Wildlife Service and its findings, locating the long-sought spawning grounds of Yukon River sheefish, are important enough to warrant publishing under the same cover as our other whitefish/sheefish studies.

ABSTRACT

Aerial tracking of radio-tagged sheefish, *Stenodus leucichthys* (Guldenstat), in the middle Yukon River located probable spawning grounds in the main Yukon River between Stevens Village and Fort Yukon. Spawning occurred in mid-October at water temperature approaching 32° Fahrenheit. Maximal distance the fish traveled upstream from the tagging site was 198 miles.

KEY WORDS

Sheefish, migrations, Yukon River, radio telemetry.

BACKGROUND

Tagging studies have shown that sheefish, *Stenodus leucichthys* (Guldenstadt), of the anadromous lower Yukon River population spawn in two distinct areas; the Koyukuk River from Hughes to at least 20 mi

upstream and the Alatna River near Siruk Creek provides spawning areas for one segment of the population, while the second segment migrates up the Yukon River beyond the Dalton Highway bridge to spawn (Alt 1974). Koyukuk-Alatna spawning grounds have been located and described by Alt (1968, 1969, 1970, 1974). Considerable effort has been expended to locate spawning grounds of the segment of the population spawning above the Dalton Highway bridge (Fig. 1). From 1972 to 1974 a tagging study was conducted at Rampart and at the Alaska Department of Fish and Game (ADF&G) research site located 19 mi above Rampart. A radio-tagging experiment was conducted in 1974, and test-netting observations were made from Rampart upstream to the Canadian border from 1972 to 1975 and in 1978 (Alt 1973, 1974, 1975, 1979). These studies did not locate spawning grounds, but they provided limited information on areas where these fish probably did not spawn. The 1978 survey of the upper Yukon River (Circle to Eagle) indicated that sheefish did not spawn in that area. Test netting in the Porcupine River in 1973 captured only fish of a local population that spawns in the main Porcupine River 0.5 mi below the mouth of the Coleen River. Test netting in the lower Chandalar River and Beaver Creek in 1975 captured only immature sheefish. In September 1975 nets set in the main Yukon River in the areas from below Fort Yukon to Stevens Village took only small numbers of prespawning sheefish of the anadromous population. The tagging study provided no useful information, as only one fish was recovered. Sheefish captured by fish wheel for tagging experienced nearly 100% tagging mortality; the 1974 radio-tagged fish met a similar fate. However, one fish captured by gill net at the 19-mi research site, fitted externally with a radio tag, and then held for 2 days prior to release was monitored upstream for 32 mi.

My previous studies of waters and fishes of the middle Yukon River and discussions with local residents and other fisheries workers caused me to conclude that probable spawning grounds would be found in the main Yukon River. Rampart residents reported that humpback whitefish, *Coregonus pidschian* (Gmelin), or broad whitefish, *C. nasus* (Pallas), or both spawned in the main Yukon River 4 to 8 mi above Rampart; ADF&G biologists captured least cisco, *C. sardinella* Valenciennes, with running sex products in the main Yukon River 2 mi below Ray River on 6 October 1983. Surveys of some of the smaller streams of the middle Yukon River indicate that, with the exception of the Porcupine, Chandalar and, possibly, Hodzana Rivers, these streams are too small to provide spawning habitat for the large population of sheefish that are present in this portion of the Yukon River. Using fish from the middle Yukon River, an attempted egg take by the Sport Fish Division on 4 October 1974 and successful egg takes by the ADF&G FRED Division in 1982-1985 indicated that these fish had a later spawning date than those fish spawning in other tributaries. If sheefish were to spawn in the tributary rivers, they would do so in early October, as these waters are freezing by mid-October.

The 1985 cooperative study (USFWS & ADF&G) hypothesized that spawning grounds of fish passing through Rampart in August and September would be in the main Yukon River below Fort Yukon but above Stevens Village. This is the heart of the Yukon Flats National Wildlife Refuge, which is administered by the U.S. Fish and Wildlife Service (USFWS). Reed Glesne

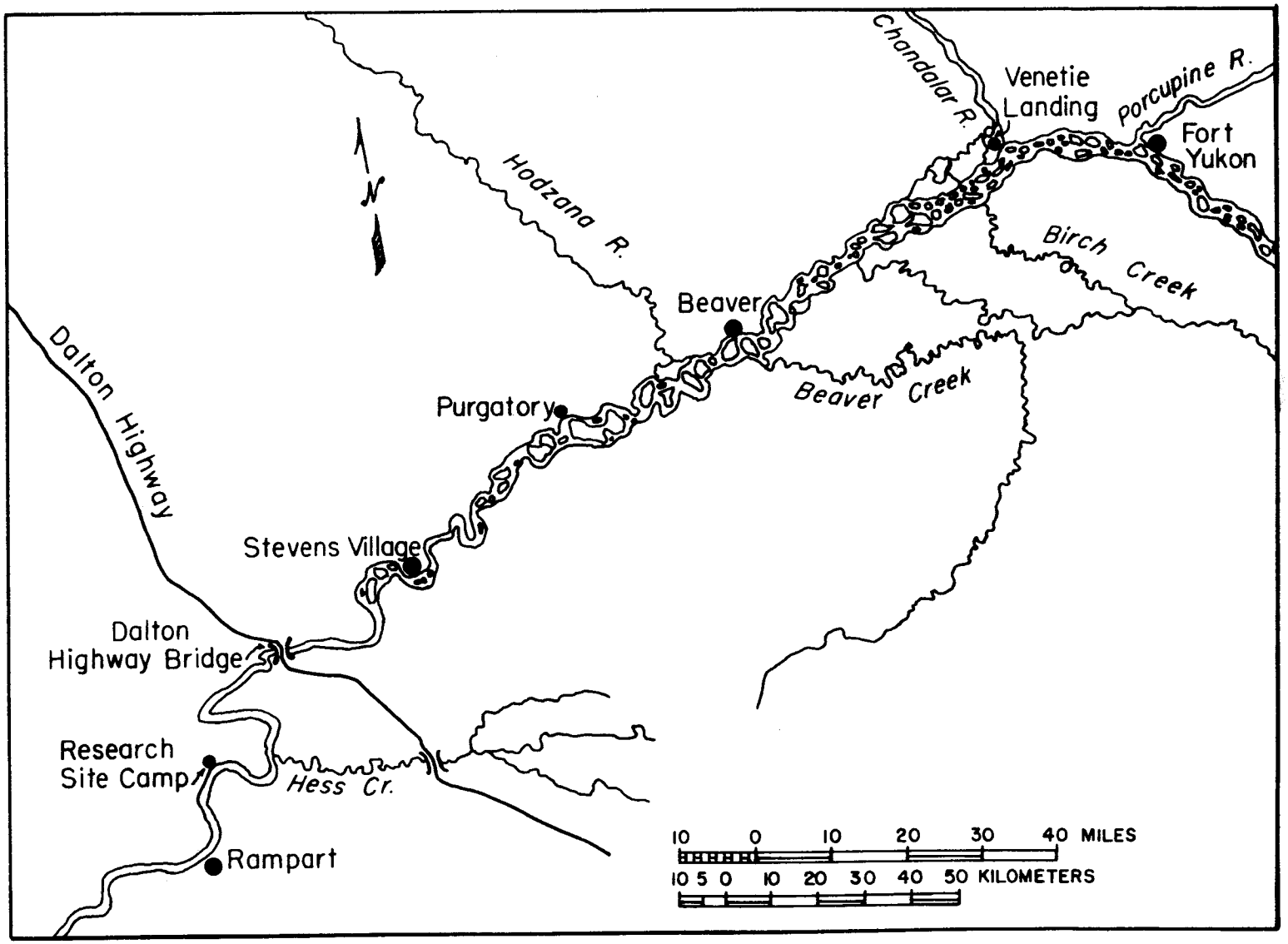

Figure 1. Middle Yukon River study area indicating tributary rivers from Rampart upstream to Fort Yukon.

and Mike Smith of the USFWS and Gary Pearse and Fred DeCicco of the ADF&G assisted in the project.

RECOMMENDATION

1. Cooperate with USFWS in test netting in the main Yukon River in the vicinity of Beaver to verify the results of the 1985 radio-tagging study.

OBJECTIVE

1. To locate the spawning grounds of sheefish of the lower Yukon anadromous population passing through Rampart in August and September.

TECHNIQUES USED

Fish for radio-tagging study were collected by gill nets set at the edge of the main current in the Yukon River at a site 19 mi upstream of Rampart. Nets were checked every 3 hours. Captured fish were placed in a tub of water, tagged with an orange Floy tag, radio-tagged, and then tethered to a stake in quiet water with 15 to 20 ft of light line. In 1985 Telonics Model RB-5 radio tags (6.5 cm length, 2 cm diameter, and 27 g weight) were used; tag frequency was 152 MHz. In contrast, in 1974 an AVM tag with a loop antennae was used (150 MHz frequency range). In 1974 tags were surgically implanted at Rampart and attached to the dorsal surface of the fish at the 19-mile site (Alt 1975).

In 1985 radio tags were implanted esophageally. The tags were coated with glycerin, placed in the mouth, and pushed into the stomach with a 12-in-long, 1-in-diameter wooden stick. The end of the antenna extended out the mouth. A 2-day study during July 1985 had shown that two dummy tags implanted esophageally were not expelled. Fish were 7 to 14 lbs in weight, and 12 of 14 were males.

In September fish were held for 1 to 3 days and released only when they appeared active and in good condition. Transmitters from fish that died or were in poor condition were removed and placed in newly caught fish. Two radio tags were surgically implanted in broad whitefish and one in a humpback whitefish.

Radio-tagged fish were initially tracked from shore and by boat utilizing an antennae mounted on a 10-ft pole. Subsequent tracking was by fixed-wing aircraft flown at an altitude of 500 to 1,000 ft. In the braided section of the Yukon Flats, each channel of the river was flown.

FINDINGS

Seventy-four sheefish were captured in 428 gill-net hours of fishing in the main Yukon River at the 19-mi research site from 17 to 25 September (Table 1). Catches were higher earlier in the study. The sheefish

Table 1. Yukon River net catches at 19-mile site, 18 to 25 September 1985.

Date	Net Hours	Species*							
		CS	SS	SF	BWF	HWF	LCI	BCI	NP
17 Sept.	2	16	1	1	0	0	0	0	0
18 Sept.	52	144	18	15	5	6	11	3	0
19 Sept.	70	106	14	11	5	3	7	0	1
20 Sept.	38	30	7	6	7	8	4	0	1
21 Sept.	48	34	6	2	6	10	11	0	0**
22 Sept.	24	11	4	2	1	2	5	0	1
23 Sept.	64	31	6	1	5	6	5	0	2
24 Sept.	68	44	9	1	12	15	10	0	0
25 Sept.	62	39	9	4	12	19	8	0	0
TOTALS:	428	455	74	43	53	69	61	3	5

* CS = chum salmon, *Oncorhynchus keta* (Walbaum)
SS = coho salmon, *Oncorhynchus kisutch* (Walbaum)
SF = sheefish, *Stenodus leucichthys* (Guldenstadt)
BWF = broad whitefish, *Coregonus nasus* (Pallas)
HWF = humpback whitefish, *Coregonus pidschian* (Gmelin)
LCI = least cisco, *Coregonus sardinella* Valenciennes
BCI = Bering cisco, *Coregonus laurettae* (Bean)
NP = northern pike, *Esox lucius* Linnaeus
GR = grayling, *Thymallus arcticus* (Pallas)
BB = burbot, *Lota lota* (Linnaeus)

** Also caught 1 grayling and 1 burbot

spawning migration through Rampart peaks the first week of September, and sheefish used in the radio-tagging study were from the end of the run.

Only mature prespawning sheefish were radio-tagged. One fish less than 550 mm in length was caught in a net in the main current, and four sheefish less than 400 mm in length were taken in a slough system below camp. These fish were immature and were not tagged. Of the fish tagged and released, only two were females (Table 2). In general the first fish caught were in poorer condition than fish caught later. For example, fish numbers 10, 11, 12, 13, and 14 were caught only by the jaw or head area and probably had been in the net only a short time. In contrast, some of the earlier fish caught were in the net overnight, were gilled, or were caught around the body, with a resultant loss of scales. However, all fish released were swimming actively and appeared to be in good condition. Water temperature during the September sampling ranged from 36° to 40°F.

Movements

After release most fish milled around the release site or moved somewhat downstream on either the north or south side of the river. By 22 September when the first aerial flight was made, one fish had moved upstream, but some of them had moved significant distances (4 to 19 mi) downstream (Table 3). By 25 September when all sheefish had been released for at least 3 days, five fish had moved upstream from 2 to 12 mi, six were at camp or at 0 to 19 mi downstream, and three fish were lost or had moved downstream of Rampart. After 25 September none of these last nine fish was found, and it is assumed they were weakened from the capture and tagging stress and moved passively downstream. The three whitefish did not move upstream (Table 2).

The five fish that did show positive movement upstream on 25 September continued their migration to the probable spawning areas (Table 3). These fish, including four males and one female, were mainly from fish caught later in the trip and were judged to be in excellent condition when tagged. On 29 September, 5 October, and 9 October, fish #11 and #13 were not located, but they were found on 15 October. They had travelled at least 130 to 183 mi from their last sighting and averaged 6.5 and 9.1 mi per day, respectively. Fish #2 averaged 13 mi per day from above the Dalton Highway bridge to the area below Purgatory; however it then only averaged 1.3 mi per day up to the probable spawning area below Hodzana Slough on the main river. Fish #10 probably moved some distance upstream after 5 October, but it had probably already spawned and left by 13 October as its radio signal was not received from Stevens Village upstream. Fish #12 moved rapidly upstream during 29 September to 13 October, averaging 11 to 14 mi per day. The 2-mi downstream movement of this fish indicates that it apparently spawned very close to the 13 October or 15 October location. Fish #13 averaged 9 mi per day from 25 September to 15 October. Fish #13 was captured by a subsistence gill-net fishermen on 28 March 1986 upstream of Emmonak at the mouth of the Yukon River.

Table 2. Release and general movement data of 17 radio-tagged fish, Yukon Rive,r 17 September to 15 October 1985. All tags were 152 MHz frequency.

Tag Frequency (152 MHz)	#	Sex	Date Released	Disposition
.562	1	M	19/9	No signal received-fish lost
.182	2	M	19/9	Fish followed to spawning ground
.573	3	M	19/9	Fish followed across river then lost; followed by airplane 22/9 to 1 mi below camp
.542	4	M	19/9	No signal received after release
.602	5	M	19/9	Below camp 21/9; at Rampart 25/9, then lost
.593	6	M	20/9	At Rampart 21/9 and 25/9 then lost
.579	7	M	20/9	6 mi below camp on 21/9; not received after that
.611	8	M	21/9	Received at camp each trip; tag ejected or fish dead
.533	9	M	21/9	4 mi below camp 21/9; 8 mi below on 25/9. Fish lost
.651	10	M	21/9	Followed to spawning area
.551	11	M	22/9	Followed to spawning grounds
.620	12	M	22/9	Followed to spawning grounds
.681	13	F	22/9	Followed to spawning grounds; then to mouth of Yukon River
.992	14	F	22/9	8 miles below camp 25/9. Fish lost

(Continued)

Table 2. (Cont'd) Release and general movement data of 17 radio-tagged fish, Yukon River, 17 September to 15 October 1985. All tags were 152 MHz frequency.

Tag Frequency (152 MHz)	#	Sex	Date Released	Disposition
.811*	15	F	25/9	Received at camp, then lost
.991*	16	F	24/9	Received at camp, then lost
.822**	17	F	25/9	Received at camp, then lost

* Broad Whitefish
** Humpback whitefish

Table 3. Locations of radio-tagged Yukon River sheefish as of 15 October 1985. Includes only fish that moved upstream from tagging site. Miles moved from last sighting are given in parentheses ().

Tag Frequency Fish # ()	DATE AND LOCATION					
	22 Sept	25 Sept	29 Sept	5 Oct	13 Oct	15 Oct
.182 (#2)	1 mi downstream	2 mi upstream (3)	10 mi above bridge (50)	2 mi below Purgatory main channel (80)	Main channel 100 yds below Hodzana Slough entrance (10)	Not found
.551 (#11)	below camp	island above Hess Creek (15)	not found	not found	not found	Main channel 15 mi above Beaver; Narrows below Joe Devlin Island (130)
.651 (#10)	not found	4 mi upstream (4)	2 mi above Little Salt R (15)	10 mi above Steven Village S. Side (25)	not found	1 mi below Rampart (-85)
.620 (#12)	just released	not found	Big Salt River (28)	Mid Hodzana Slough 2 mi below Hodzana River (85)	Main Channel 9.6 mi below Ft. Yukon Cut bank (85)	11 mi below Ft. Yukon main channel (-2)
.681 (#13)	below camp N. side	10 mi above Hess Cr. (above island) (18)	not found	not found	not found	Venetie Landing main channel N. bank; by Chandalar Slough (183)

Probable Spawning Ground Location

I feel that sheefish of the lower Yukon River anadromous population that pass the Dalton Highway bridge spawn in the main Yukon River in the Yukon Flats Wildlife Refuge from Fort Yukon downstream to at least 15 mi below Beaver.

Evidence Supporting a Main River Versus Tributary River Spawning Location:

1. The five radio-tagged sheefish that showed positive upstream movement were all located in the main Yukon River; none were located in tributaries. The lower Chandalar, Porcupine, and Hodzana Rivers were flown.

2. The tagged fish were located in the main river on 13 and 15 October when tributary rivers were freezing over. If fish were spawning in tributary rivers, they would probably spawn before 15 October. The movement of fish #12 (2 mi from 13 October to 15 October) indicates that this fish would probably spawn in the vicinity where located.

3. Average daily mileage figures for upstream migration of 6 to 14 mi per day would not allow most of these fish time to ascend tributary rivers between the times that they were located in the main river. Fish #11 and #13 could be exceptions.

4. Past years test netting captured no prespawning fish of the anadromous population in middle Yukon River tributaries.

5. Physical appearance of river (gravel, current, eddies) in areas where fish #2, #11, #12, and #13 were found (13 and 15 October) was favorable for spawning.

Evidence for Possible Tributary Spawning Grounds:

1. Two fish (#11 and #13) were not located between 25 September and 15 October, and these fish could have ascended tributary streams to spawn. Fish #11 would have had to go up the Chandalar or Porcupine Rivers or Birch Creek. Fish #13 could have ascended the Chandalar or Porcupine Rivers.

2. Tributary rivers were fairly close to fish #2 and #12.

3. Nine radio-tagged fish were never located upstream of the tagging area, and while it is believed that all were affected by tagging and lost, these fish could have migrated upstream, entered tributary streams and remained undetected.

Suggested Scenario for the Five Radio-Tagged Sheefish Monitored to the Yukon Flats:

Fish #2 moved fairly rapidly upstream to the main Yukon River near Purgatory: 50 mi in 4 days (25 to 29 September) and 80 mi in 6 days (30 September to 5 October) As this fish approached the spawning ground, its migration speed slowed; and it probably spawned in the area where

located on 13 October. This part of the main river had gravel and current similar in composition to other sheefish spawning grounds in Alaska. The fish was in a large eddy-type holding area along a cut bank with apparent deep water. I feel this fish was holding where observed and spawning out along the main current. Water temperature on 13 October was 33°F. This fish was not found on 15 October and may have completed spawning and left.

Fish #11 was not located between 25 September and 15 October; it possibly could have gone up the Chandalar or Porcupine Rivers to spawn. More likely, this fish spawned in the main Yukon River above Beaver on 15 October. For the fish to have spawned any distance up the Chandalar or Porcupine Rivers it would have had to at least double its upstream migration rate of 6.5 mi a day.

When located on 5 October above Stevens Village, fish #10 was probably migrating up to spawning grounds below Beaver. The area where the fish was found on 5 October did not appear suitable for spawning. The fish had probably completed spawning by 13 October and was below Stevens Village when our 13 October tracking flight originated there. This fish had migrated downstream to Rampart by 15 October.

On 5 October fish #12 was found 2 mi below the mouth of the Hodzana River in the middle of Hodzana Slough. It was felt that this fish might enter the Hodzana River to spawn. The lower 50 mi of the river was monitored on 5 and 13 October, and no radio-tagged fish were located. Fish #12, however, continued up Hodzana Slough into the Yukon and was found on 13 October 9.6 mi below Fort Yukon in the main river. This fish had travelled 10 mi per day and it would not have had time to migrate up the Porcupine River, spawn, and migrate back downstream in 8 days. On 15 October this fish was found 2 mi further downstream. Based on the characteristics of the river, I feel that fish #12 spawned in the 13 October location, although it could have spawned near the 15 October location.

Fish #13 was not located during much of the study, so it could have entered the Chandalar or Porcupine Rivers. More probably, it had been missed during prior flights and had spawned in the vicinity of the 15 October location. On 28 March this fish was recaptured near the mouth of the Yukon River, indicating an approximate 1,200 mi migration to overwintering grounds.

All recoveries made during the 13 October and 15 October flights were in the main channel of the Yukon River. Since sheefish normally migrate downstream fairly rapidly after spawning, it is probable that dates of spawning of at least the later part of the sheefish run is fixed at approximately 10 to 20 October. At least one of the four fish had spawned and left. Disposition of the tagged fish on 13 and 15 October suggests that spawning may occur at several locations over a wide range (up to 90 mi) of the middle Yukon River. The Yukon River water level can be expected to drop considerably from spawning time to hatching (April or May). Thus sheefish in the middle Yukon River choose spawning areas with deep and fairly swift water. The habitat that fish #2 and #12 were found in would be adequate in this respect.

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